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Life Cycle Assessment of Injection Molding Inserts: Additively Manufactured, in Brass, and in Steel

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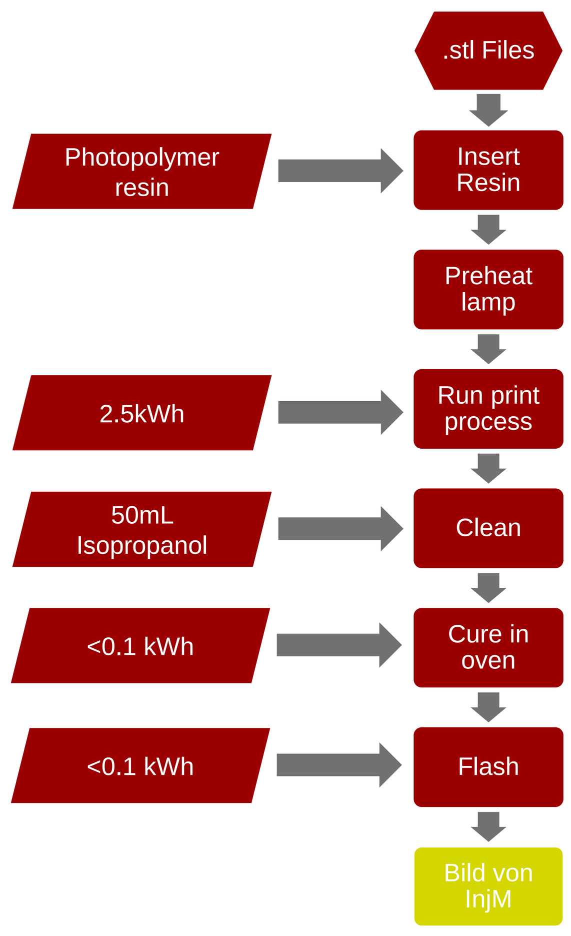
Environmental impact of 3D printing

- Screening life cycle analysis for injection molding (IM) inserts (20 x 20 x 2.6 mm^3)
- Digital light processing (DLP) allows for production of injection molding inserts used in low volume production (10 inserts for production of 300 plastic parts)
- Little information is known about the eco-impact of 3D printing materials.
- Brass is a standard material for IM inserts in low-volume and pilot production



Process diagram for 3D print process

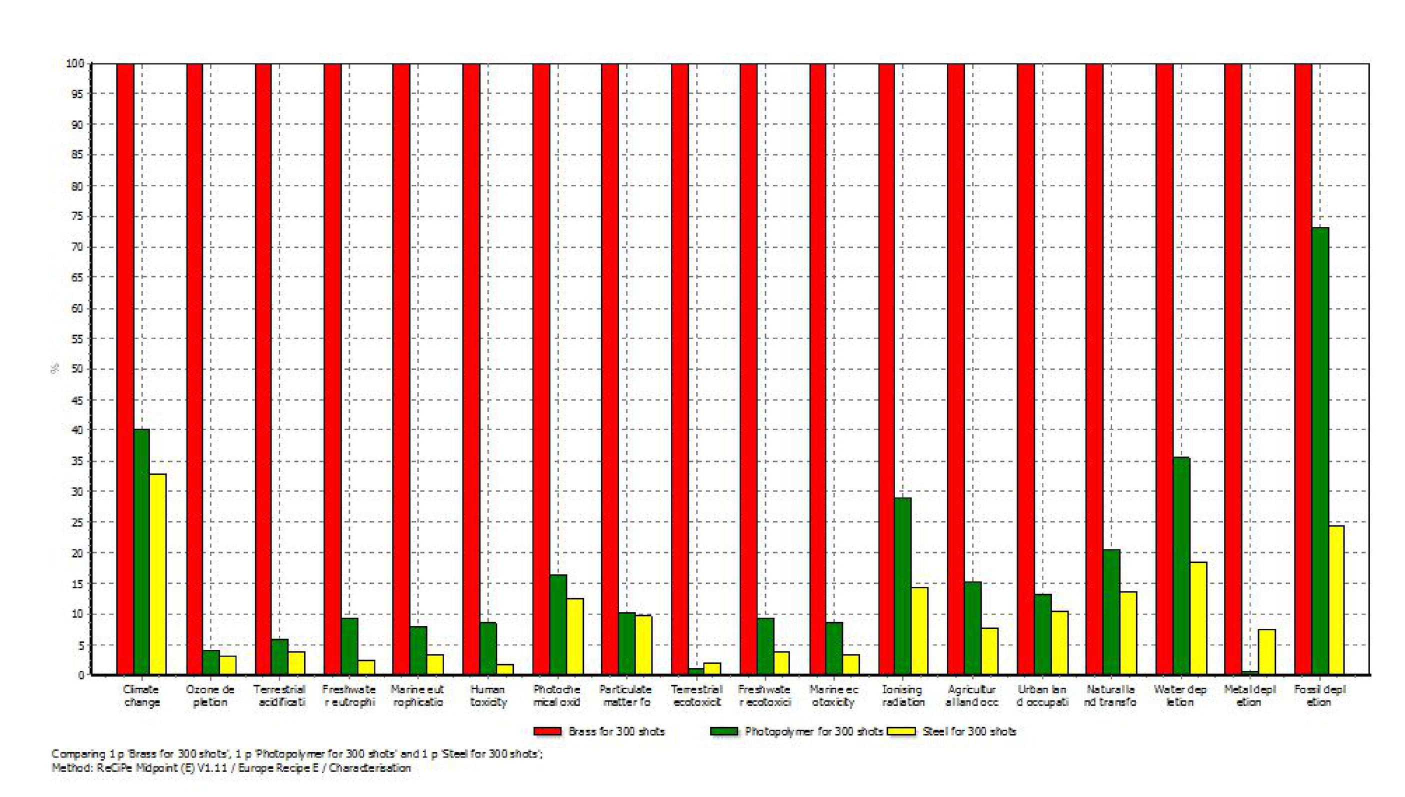
3D printed insert (left) and injection molded part (right)

Methods

- Screening life cycle analysis in SimaPro LCA software
- 1 brass insert (10,2 g), 10 photopolymer inserts (13 g in total), 1 steel insert (9,4 g)
- Material assessment (3%wt antimony in the photopolymer)

Results

- CO2 and human toxicity are the key indicators for this eco-assessment.
- 3D printing can significantly improve eco-performance compared to brass.
- Antimony in the photopolymer; exact amount unknown
- More detailed investigations necessary to qualitatively compare 3D printing and steel



Approximating Screening Life Cycle Assessment

Outlook

- Analysis of exact photopolymer composition
- Analysis of the entire process chain
- Inclusion of grey energy and similar
- Better understanding of photopolymer insert life time for more accurate assessment

3D printed inserts can reduce CO_2 by 60% and human toxicity by 92% compared to brass.

	Brass	Photopolymer	Steel
Climate Change in g CO_2 eq.	101	40.6	33.1
Human Toxicity in kg 1.4-DB eq.	95.5	8.1	1.63